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```
%-------------------------------------------
% AER 715 Avionics and Systems
% Lab 3 – "Lab Title"
% Sharvani Yadav: XXXXXXXXX
% Daniel Mielnik: 501118927
%------------------------------------------- %
```

Introduction

Type your introduction in this section

Post Lab Exercises –

```
clear all;
clc;
```

Constants for Heli 4

```
Mh = 1.450; % Mass of Heli Body (kg)
Mc = 1.918; % Mass of CW (kg)
La = 25.75/39.37; % Distance from Pivot to Helecopter body center (m)
Lb = 18.5/39.37; % Distance from Pivot to conterweight center (m)
Lh = 6.933; % Distance from pitch axis to rotor center (m)
Kf = 0.140; % Motor-Prop Force Constant (N/V)
Krt = 0.0027; % Motor-Prop Torque Constant (Nm/V)
epsilon = -26:1:30; % Elevation Range (Deg)
epsilon_0 = -25.75; % Elevation Start (Deg)
lambda = 0:1:360; % Travel Range (Deg)
g = 9.81; % Gravity constant (m/s^2)
Wh = Mh*g; % Weight of Heli Body (N)
Wc = Mc*g; % Weight of CW (N)
```

Question 1

```
fprintf('Question 1')

Je = (Mh * La^2) + (Mc * Lb^2) % Elevation Axis (kg-m^2)
```

```
Question 1
Je =

    1.0438
```

Question 2

```
fprintf('Question 2')

epsilon_dd = 0; % Figure this out
Tg = Lb*Wc - La*Wh;
Ft = (Je*epsilon_dd - Tg)/La % Lift force (N)
```

```
Question 2
Ft =

    0.7065
```

Question 3

```
fprintf('Question 3')

Vsum = Ft/Kf % Velocity required to keep helicopter at steady level flight
(m/s)
```

```
Question 3
Vsum =

    5.0465
```

Question 4

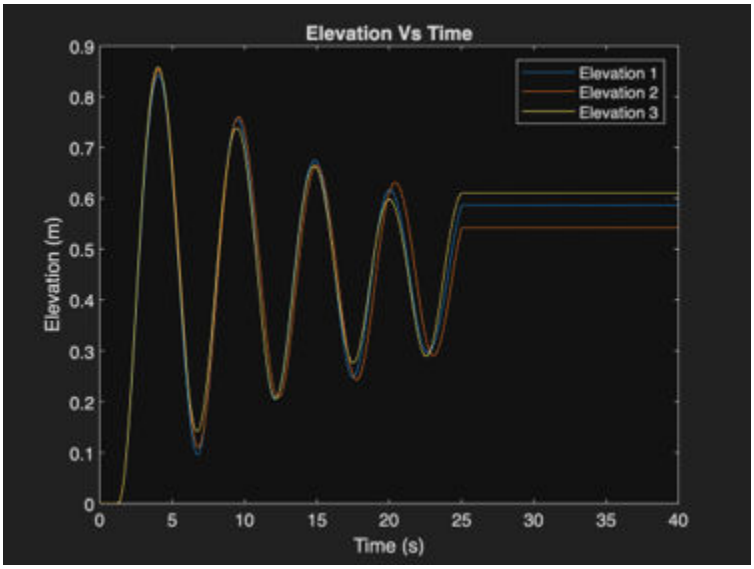
```
fprintf('Question 4')

G4_elev1 = tf(La*Kf, Je) % G elev transfer function
```

```
Question 4
G4_elev1 =

  0.08773

Static gain.
```

Question 5

```
fprintf('Question 5')

load elevationData1.mat
load elevationData2.mat
load elevationData3.mat

time = elev1(1, 1:end);

v1 = elev1(2, 1:end);
v2 = elev2(2, 1:end);
v3 = elev3(2, 1:end);

e1 = elev1(3, 1:end);
e2 = elev2(3, 1:end);
e3 = elev3(3, 1:end);

figure(1)
plot(time, e1, time, e2, time, e3)
title('Elevation Vs Time')
xlabel('Time (s)')
ylabel('Elevation (m)')
legend('Elevation 1', 'Elevation 2', 'Elevation 3')

data1 = iddata(transpose(e1), transpose(v1), 0.1);
data2 = iddata(transpose(e2), transpose(v2), 0.1);
data3 = iddata(transpose(e3), transpose(v3), 0.1);

mergedData = merge(data1, data2, data3);

G4_elev2 = tfest(mergedData, 2, 0);
G4_elev3 = tfest(mergedData, 3, 0);

[num1, denom1] = tfdata(G4_elev1, 'v')
[num2, denom2] = tfdata(G4_elev2, 'v')
[num3, denom3] = tfdata(G4_elev3, 'v')

Question 5
num1 =

    0.0916


denom1 =

    1.0438


num2 =

   1.0e-03 *
```

```
         0         0    0.2939

denom2 =

    1.0000    0.0154    0.0133

num3 =

   1.0e-04 *

         0         0         0    0.8958

denom3 =

    1.0000    0.3118    0.0178    0.0040
```



Question 6

```
fprintf('Question 6')

poles_elev2 = pole(G4_elev2)
poles_elev3 = pole(G4_elev3)
```

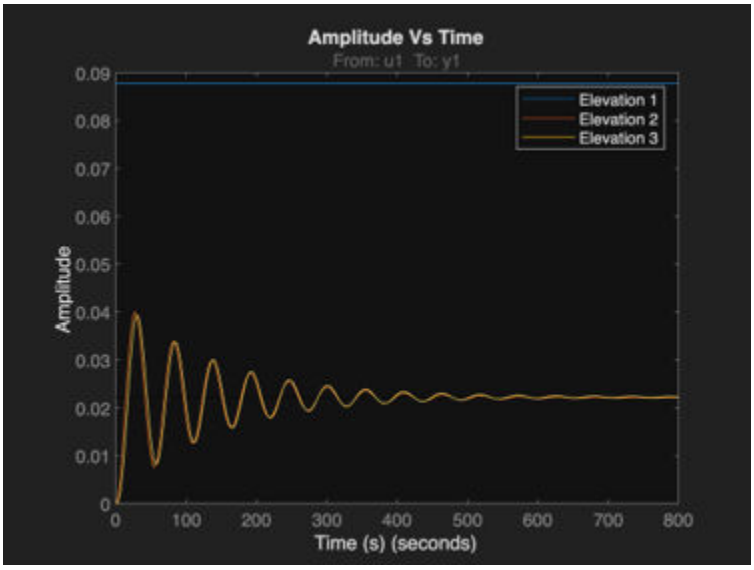
```
Question 6
poles_elev2 =

  -0.0077 + 0.1150i
  -0.0077 - 0.1150i


poles_elev3 =
```

```
  -0.2974 + 0.0000i
  -0.0072 + 0.1161i
  -0.0072 - 0.1161i
```

Question 7

```
fprintf('Question 7')

figure(2)
step(G4_elev1, G4_elev2, G4_elev3)
title('Amplitude Vs Time')
xlabel('Time (s)')
ylabel('Amplitude')
legend('Elevation 1', 'Elevation 2', 'Elevation 3')
```

```
Question 7
```



Question 8

Conclusion

Write your lab conclusion for the WHOLE lab in this section.

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